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EXAMINER
WANG, JIN CHENG

ART UNIT	PAPER NUMBER
2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	09/210,055	MILLER, JOHN DAVID
	Examiner	Art Unit
	Jin-Cheng Wang	2628

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 January 2006*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20,22,24,26,28,32,34 and 37* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20,22,24,26,28,32,34 and 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some *   c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Response to Amendments

Applicant's submission filed on 1/12/2006 has been considered. Claims 1-19, 21, 23, 25,

27, 29-31, 33, 35-36 have been canceled. Claims 20, 22, 24, 26, 28, 32, 34 and 37 are pending in

the applications.

Response to Arguments

Applicant's arguments filed January 12, 2006 have been fully considered but are moot in

view of the new ground(s) of rejection based on Shinohara U.S. Patent No. 5,880,735 (hereinafter

Shinohara-735), in view of Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and

"Foley and Van Dam, "Fundamentals of Interactive Computer Graphics", Addison Wesley 1983,

pp. 722-729, Demesa III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al.

U.S. Patent No. 5,253,339 (hereinafter Wells).

Shinohara-735 teaches a method, comprising:

Identifying a vector normal to a viewing surface (*Shihohara-735 discloses in column 8,*

lines 1-10 identifying the direction of the unit normal vector relative to the line-of-sight (viewing

vector) and the planar surface of the polygon and identifying the direction of the line-of-sight

which is a vector normal to a viewing surface such as human's face), the vector creating an angle

of incidence at the object surface (*the line-of-sight creates an angle of incidence at the planar*

surfaces of the polygon or exactly at the vertices/end points of the planar surfaces of the

polygon; column 7, lines 63-67 and column 8, lines 1-10); and

Modulating the transparency of an image of the object as <u>a function</u> of the angle of

incidence of the vector at the planar object surface (*<u>column 10, lines 22-25 Shinohara-735</u>*

<u>discloses the further the angle at which the direction of the line-of-sight intersects with the</u>

<u>planar surface of the polygon, the lower the transparency becomes</u> *and thereby disclosing that*

the transparency of the pixels at the object surface is a function of the angle of incidence of

the vector at the planar object surface).

Claim language set forth in the claims are interpreted in light of the specification, in the

following art rejection, applicant's angle of incidence in interpreted in view of the embodiment

in the specification. See Page 3 wherein applicant's disclosure includes the transparency factor is

a function of **the angle of incidence formed by the intersection of the viewing surface normal**

vector with the object surface normal vector.

Shinohara-735 is silent to the claim limitation that "wherein the function comprises a

cosine function."

However, Shinohara-769 (in view of Foley) discloses the claim limitation that "wherein

the function comprises a cosine function. Shinohara-935 discloses in column 7, lines 56-67 and

column 8, lines 1-6 that the degree of blending (i.e., transparency) is determined in accordance

with the attribute data which indicates the reflectance given to each pixel when pixel data is

generated by the filling circuit 9 wherein the filling circuit 9 sets the blending degree in the blend

parameter register in accordance with the reflectance. If the reflectance is high, data read from

the reflection map 14 is blended with the texture data with a high weight. If the reflectance is

low, blending is done with a low weight. Shinohara-769's blending of the polygon object

requires a transparency associated with the reflectance value. It is well-known in the computer

graphics art that the reflectance value is a function of the angle of incidence between the line-of-

the sight and the planar surface, for example, a cosine function as taught in the Page 729 of the

Foley 1983 textbook wherein t**he reflectance is a function of $\cos^n(\theta)$ to model specular**

reflection with the light at the viewpoint (n is the material's specular-reflection exponent).

Shinohara-769 thus teaches that the transparency or the blending degrees being a function of the

reflectance which is again a cosine function of the angle of incidence of the line-of-sight with the

planar surface (Foley) Moreover, Shinohara-769 discloses the claim limitation of identifying a

vector normal to a viewing surface and incident at an object having a planar object surface, the

vector creating an angle of incidence at the planar object surface (Shinohara-739 Fig. 2 and

column 6, lines 20-25).

It would have been obvious to one of the ordinary skill in the art at the time of the

invention was made to have incorporated Shinohara-769's teaching into Shinohara-735 because

Shinohara-735 discloses in column 11, lines 15-25 that the output transparency depends upon the

Z component of the unit normal vector at each vertex and in column 7, lines 63-67 and column 8,

lines 1-10 that the Z component of the unit normal vector at the vertex is 1 when the direction of

the unit normal vector extends at an angle of 0 relative to the direction of the line-of-sight and a

planar surface of the polygon and the direction of the line-of-sight run at a right angle to each

other. The Z component of the unit normal vector at the vertex is 0 when the direction of the unit

normal vector extends at an angle of 90 degree relative to the direction of the line-of-sight and

the planar surface of the polygon and the direction of the line-of-sight run parallel to each other.

Thus, Shinohara-735's output transparency is a function of the angle of incidence between the

line-of-sight and the planar object surface, with the value changes in consistent with a cosine

function of the angle of incidence. Shinohara-735 discloses in column 9, lines 15-25 that the

closer the angle formed by the planar surface of the polygon and the direction of the line-

of-sight become to 90 degree, the larger the Z component of the unit normal vector

becomes and therefore the larger the output transparency becomes according to the formula

set forth in column 7 and 11 wherein the output transparency is a function of the Z component.

Shinohara-735's transparency is a function of the Z component at the vertices of the planar

surface wherein the Z-component at the vertices of the planar surface is a function of the

angle of incidence. Therefore, Shinohara-735's transparency is a function of the angle of

incidence. Shinohara-735 thus suggests the claim limitation of "wherein the function comprises

a cosine function."

One of the ordinary skill in the art would have been motivated to do this to

modulate/illuminate/blend the object varying a function of the angle of incidence between the

line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8,**

lines 35-40 and Wells column 2, lines 25-40).

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The claim 1 recites a method claim. The claim states a series of steps for selecting,

determining, calculating, assigning, comparing etc. The steps include determining a viewing

angle, determining an object angle defined by a planar object surface, calculating a theta, equal

the viewing angle minus the object angle plus pi, assigning a function of theta to alpha, if the

mode is FRONT-ONLY or BOTH-SIDES, assigning a function of theta minus pi to alpha, if the

mode is BACK ONLY; comparing alpha to zero; assigning zero to alpha, if the mode is FRONT

ONLY and alpha is less than zero; assigning minus alpha to alpha, if the mode is BOTH-SIDES,

and alpha is less than zero.

The applicants have recited steps that do nothing more than manipulate basic

mathematical representations, hence the claim is unpatentable. See *In re Warmerdam,* 33 F.3d

1354, 1360 (Fed. Cir 1994).

Patentable subject matter is held to exclude laws of nature, natural phenomena, and

abstract ideas. *Diamond v. Diehr,* 450 U.S. 175, 185, 101 S.Ct 1048, 1056 (1981). Applicants'

method claim is merely associated with selecting a mode (a number), determining a viewing

angle...assigning a function... Only an applicant's claims are entitled to the protection of the

patent system; therefore claims, if expressing ideas in a mathematical form, must describe

something beyond the manipulation of ideas in order to qualify as patentable subject matter. *In*

re Warmerdam, at 1360. Given the absence of any practical effect or significant independent

physical acts, the applicants' claim fails to adequately define the claimed invention within the

domain of patentable subject matter.

The claimed invention as a whole must accomplish a practical application. That is, it

must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d

at 1601-02. The purpose of this requirement is to limit patent protection to inventions that

possess a certain level of "real world" value, as opposed to subject matter that represents nothing

more than an abstract idea or mathematical concept, or is simply a starting point for future

investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In

re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly,

a complete disclosure should contain some indication of the practical application for the claimed

invention, i.e., why the applicant believes the claimed invention is useful. Given the absence of

any practical effect or significant independent physical acts, the applicants' claim fails to

adequately define the claimed invention within the domain of patentable subject matter.

Claim 22, 24, 26, 28 are rejected for the same reason set forth in above.

Claim Rejections - 35 USC § 112-First Paragraph

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making
and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it
pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode
contemplated by the inventor of carrying out his invention.

Claims 22, 24, 26, 28, 32, 34 and 37 are rejected under 35 U.S.C. 112, first paragraph, as

failing to comply with the enablement requirement. The claim(s) contains subject matter which

was not described in the specification in such a way as to enable one skilled in the art to which it

pertains, or with which it is most nearly connected, to make and/or use the invention.   For

example, claim 22 recites the claim limitation of "identifying a vector normal to a viewing

surface and incident at an object having a planar object surface, the vector creating an angle of

incidence at the planar object surface".

However, the specification discloses a different "angle of incidence". See Page 3 wherein

applicant's disclosure includes the transparency factor is a function of the angle of incidence

formed by **the intersection of the viewing surface normal vector with the object surface**

normal vector. Please note that this definition of the angle of incidence set forth in the specification is <u>completely different</u> from the angle of incidence set forth in the claims 22, 24, 26, 28, 32, 34 and 37.

Claim Rejections - 35 USC § 112-Second Paragraph

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 37 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The scope of claim 37 is confusing as it is unclear whether a computer readable medium or a method is being claimed. It is noted that the body of the claim is written as a method claim comprising modulating steps; however, the preamble of claim 37 is confusing. Clarification is required.

Claims 32 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 32 and 34 are confusing with regard to "a computer program capable of being executed" recited. First, a computer program not yet being executed in the computer such as the

computer program written in a piece of paper is capable of being executed. Clarification is

required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 22, 24, 26, 28, 32, 34 and 37 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Shinohara U.S. Patent No. 5,880,735 (hereinafter Shinohara-735), in view of

Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and "Foley and Van Dam,

"Fundamentals of Interactive Computer Graphics", Addison Wesley 1983, pp. 722-729, Demesa

III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al. U.S. Patent No.

5,253,339 (hereinafter Wells).

Re Claims 22, 24, 26, 28 32, 34 and 37:

Shinohara-735 teaches a method, comprising:

Identifying a vector normal to a viewing surface (Shihohara-735 discloses in column 8,

lines 1-10 identifying the direction of the unit normal vector relative to the line-of-sight (viewing

vector) and the planar surface of the polygon and identifying the direction of the line-of-sight

which is a vector normal to a viewing surface such as human's face), the vector creating an angle

of incidence at the object surface (*the line-of-sight creates an angle of incidence at the planar*

surfaces of the polygon or exactly at the vertices/end points of the planar surfaces of the

polygon; column 7, lines 63-67 and column 8, lines 1-10); and

Modulating the transparency of an image of the object as <u>a function</u> of the angle of incidence of

the vector at the planar object surface (***column 10, lines 22-25 Shinohara-735 discloses the***

further the angle at which the direction of the line-of-sight intersects with the planar surface

of the polygon, the lower the transparency becomes *and thereby disclosing that the*

transparency of the pixels at the object surface is a function of the angle of incidence of the

vector at the planar object surface).

Claim language set forth in the claims are interpreted in light of the specification, in the

following art rejection, applicant's angle of incidence in interpreted in view of the embodiment

in the specification. See Page 3 wherein applicant's disclosure includes the transparency factor is

a function of **the angle of incidence formed by the intersection of the viewing surface normal**

vector with the object surface normal vector.

Shinohara-735 is silent to the claim limitation that "wherein the function comprises a

cosine function."

However, Shinohara-769 (in view of Foley) discloses the claim limitation that "wherein

the function comprises a cosine function. Shinohara-935 discloses in column 7, lines 56-67 and

column 8, lines 1-6 that the degree of blending is determined in accordance with the attribute

data which indicates the reflectance given to each pixel when pixel data is generated by the

filling circuit 9 wherein the filling circuit 9 sets the blending degree in the blend parameter

register in accordance with the reflectance. If the reflectance is high, data read from the

reflection map 14 is blended with the texture data with a high weight. If the reflectance is low,

blending is done with a low weight. Shinohara-769's blending of the polygon object requires a

transparency associated with the reflectance value. It is well-known in the computer graphics art

that the reflectance value is a function of the angle of incidence between the line-of-the sight and

the planar surface, for example, a cosine function as taught in the Page 729 of the Foley 1983

book wherein t**he reflectance is a function of $\cos^n(\theta)$ to model specular reflection with the**

light at the viewpoint (n is the material's specular-reflection exponent). Shinohara-769 thus

teaches that the transparency or the blending degrees being a function of the reflectance which is

again a cosine function of the angle of incidence of the line-of-sight with the planar surface

(Foley) Moreover, Shinohara-769 discloses the claim limitation of identifying a vector normal to

a viewing surface and incident at an object having a planar object surface, the vector creating an

angle of incidence at the planar object surface (Shinohara-739 Fig. 2 and column 6, lines 20-25).

It would have been obvious to one of the ordinary skill in the art at the time of the

invention was made to have incorporated Shinohara-769's teaching into Shinohara-735 because

Shinohara-735 discloses in column 11, lines 15-25 that the output transparency depends upon the

Z component of the unit normal vector at each vertex and in column 7, lines 63-67 and column 8,

lines 1-10 that the Z component of the unit normal vector at the vertex is 1 when the direction of

the unit normal vector extends at an angle of 0 relative to the direction of the line-of-sight and a

planar surface of the polygon and the direction of the line-of-sight run at a right angle to each

other. The Z component of the unit normal vector at the vertex is 0 when the direction of the unit

normal vector extends at an angle of 90 degree relative to the direction of the line-of-sight and

the planar surface of the polygon and the direction of the line-of-sight run parallel to each other.

Thus, Shinohara-735's output transparency is a function of the angle of incidence between the

line-of-sight and the planar object surface, with the value changes in consistent with a cosine

function of the angle of incidence. Shinohara-735 discloses in column 9, lines 15-25 that the

closer the angle formed by the planar surface of the polygon and the direction of the line-

of-sight become to 90 degree, the larger the Z component of the unit normal vector

becomes and therefore the larger the output transparency becomes according to the formula

set forth in column 7 and 11 wherein the output transparency is a function of the Z component.

Shinohara-735's transparency is a function of the Z component at the vertices of the planar

surface wherein the Z-component at the vertices of the planar surface is a function of the

angle of incidence. Therefore, Shinohara-735's transparency is a function of the angle of

incidence. Shinohara-735 thus suggests the claim limitation of "wherein the function comprises

a cosine function."

One of the ordinary skill in the art would have been motivated to do this to

modulate/illuminate/blend the object varying a function of the angle of incidence between the

line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8,**

lines 35-40 and Wells column 2, lines 25-40).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Obata U.S. Patent

No. 5,222,203 (hereinafter Obata) in view of Shinohara U.S. Patent No. 5,880,735 (hereinafter

Shinohara-735) and Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and

"Foley and Van Dam, "Fundamentals of Interactive Computer Graphics", Addison Wesley 1983,

pp. 722-729, Demesa III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al.

U.S. Patent No. 5,253,339 (hereinafter Wells).

Claim 20:

Obata teaches selecting a mode, the mode is FRONT-ONLY, BOTH SIDES, or BACK-

ONLY (*The mode is **in relation to** the viewpoint vector, the light source vector and the normal*

vector of the object surface. The directions of these vectors govern the mode for FRONT-ONLY,

BOTH SIDES, or BACK-ONLY; column 7),

determining a viewing angle (Determining VE to be the same as VL; *Obata discloses*

viewpoint vector in Fig. 2 wherein the eye position changes with respect to the object surface

which in turn changes the mode with respect to the object. It would have been obvious to move

the viewpoint position exactly at the light source position so that the viewpoint vector coincides

with the light source vector and therefore theta depends on the normal vector at the object

surface and the viewpoint vector as the viewpoint vector coincides with the light source vector.

Moreover, Obata has extra freedom of selecting/determining both the viewpoint vector and the

light source vector. The opposite light source vector –VL with respect to the reference x-axis of

an arbitrary reference frame forms the viewing angle and the light source vector VL coincides

with the viewpoint vector VE. For the sake of subsequent explanation, the angle is denoted by

va_alpha),

determining an object angle defined by a planar object surface (*e.g., object having*

surfaces have been described through the cited reference and therefore the object as taught by

the reference refers to the three-dimensional object rather than a two-dimensional object. The

lines illustrated in Figs. 2, 8 and 10 as related to the translucent object wherein the light source

and viewpoint vectors intersect with represent the planar surfaces of the object in which the

transparency of the object surface is the subject matter. <u>Determining VN</u>; The normal vector of

the planar object surface with respect to the reference x-axis of an arbitrary reference frame

forms the object angle. For the sake of subsequent explanation, the angle is denoted by oa_beta.

Moreover, Fig. 6 shows an object with planar surfaces and thus the object as taught by the cited

reference is three-dimensional rather than two-dimensional. Thus, the description as related to

Fig. 2 applied to three-dimensional object having planar surfaces illustrated in Fig. 6 and the

viewpoint vector and light source vector intersect with the planar surfaces of the translucent

object; See also Figs. 8 and 10),

calculating a theta, equal the viewing angle minus the object angle plus pi (*theta is the*

angle between the normal vector VN and the viewpoint vector VE which is in relation to the

previously identified viewing angle and object angle. By definition of theta, theta is equal to pi –

oa_beta + va_alpha; column 7),

assigning a function of theta to alpha, if the mode is FRONT-ONLY or BOTH-SIDES

(*the alpha being the cosine function of theta; see column 6*),

Obata explicitly discloses in Figs. 2 and 8 the angle of incidence theta and the brightness

value or the color value depends on a non-linear function of the angle theta (column 6-7). From

Obata's disclosure, the theta angle depends on the light source vector VL and the normal vector

VN. By definition, the angle theta is equal to pi – {the angle between the normal vector VN of the

object surface with respect to the x-axis of any reference frame} + {the angle of the opposite

light source vector –VL (viewing from the light source) with respect to the x-axis of any

reference frame}. The angle between the normal vector VN of the object surface with respect to

the x-axis of any reference frame is the object angle of the claimed invention and the angle of the

opposite light source vector −VL as viewing from the light source with respect to the x-axis of

any reference frame forms the viewing angle of the claimed invention. The viewing angle and the

object angle are inferred from the Obata's disclosure in Figs. 2 and 8 and column 6-7. The

viewing angle and the object angle are directly related to the angle theta and the angle theta is

critical for the determination of the color value or the transparency value and Obata.

Because the color value or transparency value can never be less than zero, alpha = cos

(theta) should be always larger than or equal to zero, Obata implicitly teaches comparing alpha

to zero; assigning zero to alpha, if the mode is FRONT_ONLY (FRONT_ONLY mode is a mode

formed by the position or location of the viewing source or the light source in relation to the

object surface and therefore is decided by the relationship of the viewing source vector or the

light source vector VL and the normal vector VN at the object surface) and alpha is less than

zero. Similarly, Obata implicitly teaches the transparency value to be larger than zero or equal

to zero and thereby Obata teaches assigning zero to alpha, if the mode is BACK_ONLY, and

alpha less than zero. Because the color value or transparency value can never be less than zero,

alpha = cos (theta) should be always larger than or equal to zero, Obata implicitly teaches

assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero (column

6-7). These above steps are measures to prevent the alpha value being less than zero which one

of the ordinary skill in the art should understand that alpha value for alpha blending should not

be less than zero.

Therefore, Obata further discloses assigning a function of theta minus pi to alpha, if the

mode is BACK ONLY (*Note that the mode changes when the light source and the viewpoint*

changes with respect to the object surface. Assigning a function of theta minus pi is equivalent to

assigning a function of theta because cosine of theta minus pi reflects the brightness value after

blending with the light source or the background image and is equal in absolute value to cosine

of theta. BACK_ONLY corresponds to the viewpoint vector VE and the light vector being in

opposite direction in which VN is rotated 180 degrees to obtain a normal vector and

FRONT_ONLY corresponds to the viewpoint vector VE being in the same direction to the light

source vector VL; column 6-7);

comparing alpha to zero; assigning zero to alpha, if the mode is FRONT ONLY and

alpha is less than zero (*Since the brightness value for an image object should be positive, the*

inner product between the normal vector of the object surface and the light source vector or

cosine(pi – oa_beta +va_alpha) should be positive as well; column 6-7); assigning zero to

alpha, if the mode is BACK ONLY, and alpha less than zero (*the image object is displayed as an*

opaque object and since the brightness value for an image object should be positive, alpha value

should be zero if it is less than zero);

assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero

(*since the brightness value for an image object should be positive, alpha value should be zero if*

it is less than zero; column 6-7).

In other words, Obata discloses a method for displaying a translucent object or an opaque

object on a display screen comprising a step of displaying a translucent object by calculating the

color intensity. The color intensity comprises an ambient light component and the diffused

transmitted light component, which is in relation to an angle made between a normal vector of

the object surface and a light source vector as being at normal to the light surface, the diffused

transmitted light coefficient, and the intensity value corresponding to the light source. The angle

of incidence of the incident light source being over the range of 0 to pi, so that the object

develops its own color intensity on the basis of the diffused transmitted light coefficient Ktr, the

intensity value corresponding to the incident light from a light source. The intensity or brightness

of the image object is described by the color and/or transparency values. Obata teaches that, <u>the</u>

<u>actual display color of the image object is determined by</u> **mixing the color of the image object**

and the color of the background image, <u>based upon the transmissivity of the translucent object</u>

(column 1). *The transmissivity of the object is reflected as coefficient value in the image*

blending which is not related to the alpha value at all. Obata teaches that, by appropriately

setting the coefficients associated with the intensity components, the display of an opaque object

or a translucent object can be controlled in such a way that an opaque object can be displayed by

providing a zero value output from <u>the diffused transmitted light</u> component and a translucent

object can be displayed by providing zero value outputs from the diffused reflection light

component and the specular reflection light component (column 7) wherein the background

object is displayed as blurred to obtain a superior realistic display (column 6). In the case for

translucent image object, the intensity of the image object is governed by the Itr component

which is proportional to the transparency factor. The transparency of the image object is

determined by a number of the input parameters such as the diffused transmitted light coefficient

and reflection coefficient of ambient light depending upon the relationship among the light

source, the viewpoint and the object surface. The transparency is zero for an image object to be

displayed as an opaque object after setting the coefficients associated with the intensity

components or parameters under certain conditions. The intensity of the diffused transmitted

light greatly varies in accordance with the angle theta made between the normal vector of the

object surface and the light source vector as being normal to the light source surface and how

much the light comes through depends upon the cosine function of theta. The angle theta is

usually 0 to pi, and theta = pi signifies the case that the object surface is at a position opposite to

the light source, whereas theta = 0 means the case that the object surface is in a parallel and

opposed relation to the light source so that it is in the most bright condition.

Moreover, Obata a mode is in relation to the viewpoint vector, the light source vector and

the normal vector of the object surface. The directions of these vectors govern the mode for

FRONT-ONLY, BOTH SIDES, or BACK-ONLY. The three vectors offer extra freedom in

selecting a mode.

Although Obata does not explicitly disclose that the viewpoint vector to be exactly the

same as the light source vector, it would have been obvious to locate the viewpoint to the same

position as the light source as the viewpoint position can be moved to the light source position.

Obata at least suggests the viewpoint vector to be exactly the same as the light source vector by

stating that the viewpoint and the light source are determined to be on the same side of the

translucent surface and Fig. 2 also discloses that the viewpoint vector and the light source vector

are in the opposite side of the object surface and therefore Obata teaches that the viewpoint

position is movable with respect to the object surface.

It would have been obvious to move the viewpoint position exactly at the light source

position so that the viewpoint vector coincides with the light source vector and therefore theta

depends on the normal vector at the object surface and the viewpoint vector as the viewpoint

vector coincides with the light source vector. Moreover, Obata has extra freedom of

selecting/determining both the viewpoint vector and the light source vector.

One of the ordinary skill in the art would have been motivated to move viewpoint

position at the light source position to view the translucent surface of the object (Obata column

7, lines 33-65) and *the eye position changes with respect to the object surface which in turn*

changes the mode with respect to the object (Fig. 2).

However, Obata does not specifically teach the claim limitation of "assigning a

transparency factor to alpha".

Shinohara-735 discloses the claim limitation of assigning a transparency factor to alpha

(e.g., Shinohara teaches determining a transparency at each pixel based upon a Z component of

the unit vectors and the factor is related to the angle at which the direction in which the surface

of the polygon is inclined and therefore it becomes possible to change the transparency

depending upon the angle relative to the direction of the line-of-sight and the planar surface;

column 4, lines 1-50; and column 7, lines 36-62. Shinohara further discloses that the Z-

component of the unit vector depends on the angle formed by the planar surface of the polygon,

the direction of the line-of-sight. See column 1, lines 60-67 and column 2, lines 1-2; see column

9. P=1, Nz=cos(theta); and a_out = a_in * Nz; see column 7, lines 35-67 and column 8, lines 1-

9 in which Nz changes from 0 to 1 and therefore the output transparency is changed from

opaque a_out = 0 to clear a_out = a_in; see also column 1).

It would have been obvious to have incorporated Shinohara-735's assigning a

transparency factor to alpha to Obata's method because Obata suggests the claim limitation of

"assigning a transparency factor to alpha". In column 1 and 6-7, Obata teaches that, <u>the actual</u>

<u>display color of the image object is determined by</u> **mixing the color of the image object and**

the color of the background image, <u>based upon the transmissivity of the translucent object</u>

<u>which **dictates** the coefficients associated with the formula for calculating the brightness values</u>

(column 1).

Shinohara-769 (in view of Foley) discloses the mixing of the color of the image object

and the color of the background image is governed by a blending degree as a function of the

reflectance value. Shinohara-935 discloses in column 7, lines 56-67 and column 8, lines 1-6 that

the degree of blending is determined in accordance with the attribute data which indicates the

reflectance given to each pixel when pixel data is generated by the filling circuit 9 wherein the

filling circuit 9 sets the blending degree in the blend parameter register in accordance with the

reflectance. If the reflectance is high, data read from the reflection map 14 is blended with the

texture data with a high weight. If the reflectance is low, blending is done with a low weight.

Shinohara-769's blending of the polygon object requires a transparency associated with the

reflectance value. It is well-known in the computer graphics art that the reflectance value is a

function of the angle of incidence between the line-of-the sight and the planar surface, for

example, a cosine function as taught in the Page 729 of the Foley 1983 book wherein <u>the</u>

<u>**reflectance is a function of $\cos^{n}(\theta)$ to model specular reflection with the light at the**</u>

<u>**viewpoint**</u> (n is the material's specular-reflection exponent). Shinohara-769 thus teaches that the

transparency or the blending degrees being a function of the reflectance which is again a cosine

function of the angle of incidence of the line-of-sight with the planar surface (Foley) Moreover,

Shinohara-769 discloses the claim limitation of identifying a vector normal to a viewing surface

and incident at an object having a planar object surface, the vector creating an angle of incidence

at the planar object surface (Shinohara-739 Fig. 2 and column 6, lines 20-25).

With the teaching of Shinohara-739 and Foley, it is understood the interrelationship of

the blending factor and the specular reflectance factor as a function of the angle formed by the

direction of the line-of-sight and the planar object surface. In column 1 and 6-7, Obata teaches

that, the actual display color of the image object is determined by **mixing the color of the image**

object and the color of the background image wherein the mixing depends upon the

specular reflectance factor as a function of the angle formed by the direction of the line-of-

sight and the planar object surface.

Moreover, it should be known that Obata teaches that, by appropriately setting the

coefficients associated with the intensity components, the display of an opaque object or a

translucent object can be controlled in such a way that an opaque object can be displayed by

providing a zero value output from the diffused transmitted light component and a translucent

object can be displayed by providing zero value outputs from the diffused reflection light

component and the specular reflection light component (column 7) wherein the background

object is displayed as blurred to obtain a superior realistic display (column 6). In the case for

translucent image object, the intensity of the image object is governed by the Itr component

which depends upon the material transparency factor. The brightness value of the image object is

determined by a number of the input parameters such as the diffused transmitted light coefficient

and reflection coefficient of ambient light and the final brightness result of the image object

depends upon the material transparency value. The transparency is zero for an image object to be

displayed as an opaque object after setting the coefficients associated with the intensity

components or parameters, depending on the relationship among the light source, viewpoint and the object surface. The intensity of the diffused transmitted light greatly varies in accordance with the angle theta made between the normal vector of the object surface and the light source vector (viewpoint vector) as being normal to the light source surface (or viewpoint surface). The angle theta is usually 0 to pi, and theta = pi signifies the case that the object surface is at a position opposite to the light source, whereas theta = 0 means the case that the object surface is in a parallel and opposed relation to the light source so that it is in the most bright condition.

Finally, Obata teaches that, *by appropriately setting the coefficients associated with the intensity components*, the display of an opaque object or a translucent object (two different opacity values associated with the same image object) is realized. In the case for translucent image object, the intensity of the image object is governed by the Itr component and therefore **Itr is proportional to the transparency factor** for the blending of the effect of light source and the translucent image object. In this case, the brightness value is only determined by Itr because he transparency of the image object with respect to the light source is determined by a number of the input parameters such as the diffused transmitted light coefficient and reflection coefficient of ambient light wherein only Itr component determines the color of the translucent image object (column 7, lines 12-25) so that *the outline of a light source* which is *__seen through__* (blended with opacity values) **the translucent object is blurred to obtain a superior realistic display of the translucent object**. The other term in the image blending as being proportional to (1-alpha) is set to zero due to the fact that the coefficients related to other components are set to zero. Note that the transparency is zero for an image object to be displayed as an opaque object after setting the coefficients associated with the intensity components or parameters.

In a non-limiting example, the transparency or opacity value of an image object pixel is proportional to cos (theta) which is the inner product between the normal vector of the object surface and the viewpoint vector being perpendicular to the viewing surface (say eye ball). If the viewpoint vector is in perpendicular to the object surface, cos (theta) = 1, resulting in the maximum opacity. It is also noted that the viewpoint vector and the light source vector of the prior art reference may be changed instead of fixed relative to each other and therefore this example applies only to a very specific situation in which the sheet face or the object surface being perpendicular to the viewpoint while the viewpoint vector and the light source vector are in opposite direction. If both the viewpoint and the light source are perpendicular to the sheet of paper, the transparency or opacity of the sheet of paper is maximum because cos(theta) = 1.

It would have been obvious to have incorporate Shinohara's assigning the transparency factor to alpha into Obata's method for *setting the coefficients associated with the intensity components* so that the display of an opaque object or a translucent object (two different opacity values associated with the same image object) is realized.

Therefore, according to the teaching of Obata, it would have been obvious to assign a transparency factor to alpha similar to what has been done in Shinohara. Doing so would enable the modification of the color of the object by **mixing the color of two image objects such as the image object and the color of background image**. One of the ordinary skill in the art would have been motivated to do this to modulate/illuminate/blend the object varying a function of the angle of incidence between the line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8, lines 35-40 and Wells column 2, lines 25-40**).
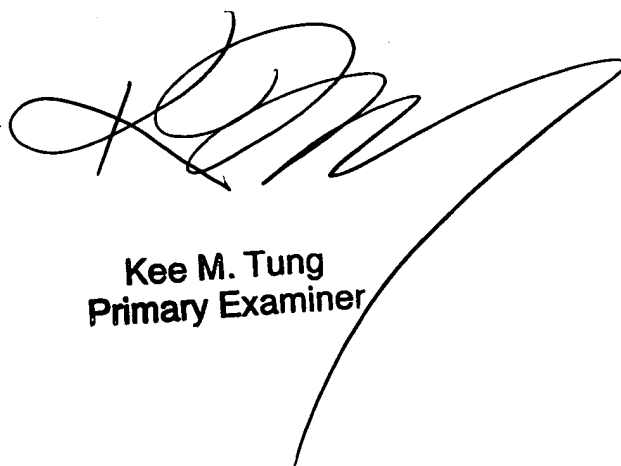
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jin-Cheng Wang whose telephone number is (571) 272-7665. The examiner can normally be reached on 8:00 - 6:30 (Mon-Thu).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee Tung can be reached on (571) 272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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jcw

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